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GASES MET WITH IN MINES.

WM. RALSTON, NEUMAN, O.

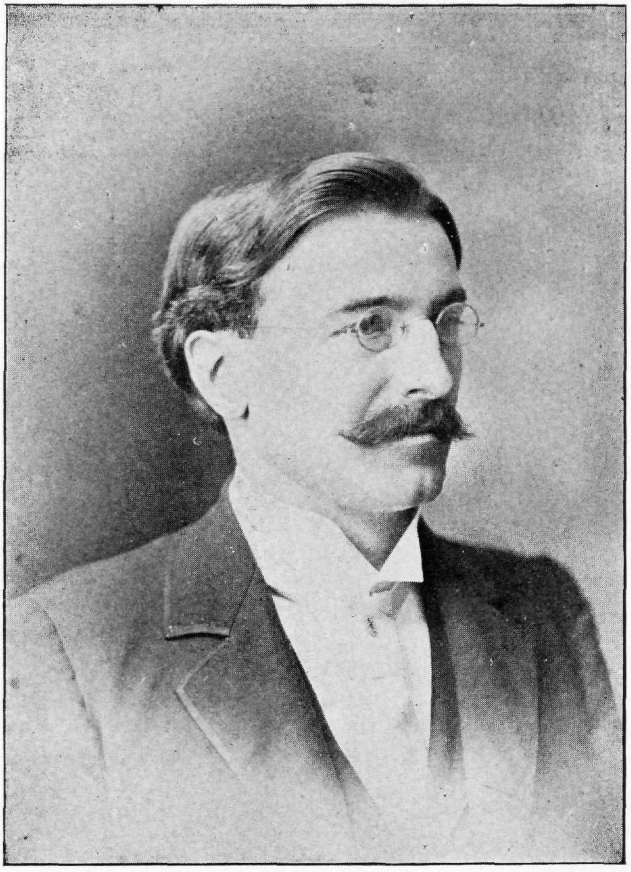
1st. Carbonic acid, or Carbonic Anhydrate. That is, it is composed of one atom of carbon and two atoms of oxygen. Its chemical symbols=CO_2, its specific gravity=1.52; it is one and a half ($1\frac{1}{2}$) times heavier than air. Therefore it is found on the floor of the mines before it is mixed with the air. It is called choke damp, black damp or stythe by the miner. It is colorless, invisible and has a sharp odor and taste. It is composed of 72.7% of oxygen and 27.3% of carbon by weight. A common test for it is, that a candle will go out in air containing 10%of it. Air containing 3 or 4% is unfit for respiration. Air containing 6% is dangerous to breathe, 8 or 10% is fatal to life.

Some coal seams are subject to blowers of black damp (Co_2) very much in the same way as others are subject to fire damp.

Blowers are usually detected as a cool air on the back of the hand.

Black damp (CO_2) is also found in wells and should be tested before going down. If present in dangerous qauntities a lamp flame is put out by it. It may be removed in various ways: 1st, quicklime in the process of slacking, which absorbs the gas; 2nd, by letting water fall down; 3rd, by drawing up the bucket several times.

Carbonic Oxide. Chemical symbols=CO, one atom of carbon and one atom of oxygen; specific gravity=.975. It is a little lighter than air. Out of 100 parts by weight there are 56.75% of oxygen and 43.3% of carbon. It is called white damp by the miners. It is colorless, tasteless and poisonous, yet it has a slight peculiar odor. Now it does not in the ordinary sense support combustion, yet a candle and lamp will burn in it with a mixture of air which at once destroys life. It is more poisonous than black damp (CO_2). Air containing 1%of it is at once fatal to warmblooded animals breathing it. The most striking properties of it is, that it is itself combustible and burns with a beautiful blue flame. White damp (CO) is poison and enters the blood through the lungs. Its presence can only be detected after death. The report of the French Fire commission gave its temperature of ignition at 1202°F.



WM. RALSTON

Sulphuretted Hydrogen or Hydrogen Sulphide. Chemical symbols=H_2S, two atoms of hydrogen and one atom of sulphur. Specific gravity=1.17. It is a little heavier than air. It is a poisonous and colorless gas. It does not support combustion or respiration, but is itself combustible and burns with a blue flame. Water dissolves from two and a half to three times its volume, of the gas, and acquires its offensive taste and odor. Consequently, it may be carried in the mine in the state of solution by the water and afterward liberated. This gas, Hydrogen Sulphide gas (H_2S), is injuirious in the mines in various ways by its effect on the iron rails, pumps, etc.

It is found in mines as decomposition of pyrites or of some animal substance containing sulphur, and a result of exploding gunpowder. The exact proportion of Sulphuretted Hydrogen (H_2S) is not known that is fatal to life; some authorities give it at $\frac{1}{2}$ to 4%. Light continues to burn in it and its presence can only be detected by its odor.

Proto Carburetted Hydrogen. Its chemical symbols= CH_4. Fire damp or inflamable gas met with in mines. Its specific gravity=.56. It is considerably lighter than air, and owing to its lightness it has a tendency to rest against the roof of mines and in the cavities unless it is displaced by an air current acting on it. It is a colorless inodorous gas. It is scarcely soluble in water (H_2O) and does not support combustion or respiration. It is not a poisonous gas, but if breathed in a pure state it causes death, because it does not support respiration. It issues as a product of decomposition from the seams of coal, and when mingled with the air in certain proportions it forms an explosive mixture and any flame applied to the mixture causes an explosion, and many sad and destructive accidents of this description are brought to our notice. When fire damp (CH_4) forms 1 part to 30 of air and gas its presence can be detected by the cap from the safety lamp. The maximum explosive mixture of fire damp (CH_4) and air is 9.6 air to 1 fire damp. The French Fire Damp commission gives its temprature of ignition at 1436°F.

Now the origin of the existence of gas in coal is a matter of uncertainty. The coal being formed by vegetable matter, it is quite possible that during the process of decomposition new strata accumulated to such an extent as to cause considerable pressure and when these newly deposited strata were of a porous nature the gas given off would escape through the strata to the surface. But when the cover over the vegetable matter was impermeable the gas was retained at the increasing pressure as decomposition proceeded and coal seams fully matured.

After Damp. The exact composition of after damp will

depend upon the composition of the explosive mixture. The commonest are black damp (CO_2) plus nitrogen (N) plus water (H_2O) in round numbers $1CO_2+7N+2H_2O$ given as steam.

SECRETARY HASELTINE: I move a vote of thanks to Mr. Morrison and Mr. Ralston for their papers.

Seconded: Carried.

PRESIDENT RAY: I see Mr. Wilkins is with us now and I will call on him for his paper, "Surface Plants of Bituminous Collieries."

The following paper read by W. G. Wilkins, C. E., Pittsburg, Pa.: